Arkansas Department of Career Education
Model Framework

Course Title: **Welding Technology**

Career Cluster: **Manufacturing**

Secondary – Skilled and Technical Sciences		
Course Number	495570	
CIP Number	48.0508	
Grade Level	9-12	
Prerequisite	None	
Course Type	Core	
Teacher Certification	597	
CTSO	SKILLS	SKILLS
Facility Requirements	http://arkansasfacilities.arkansas.gov/facilities/academic-facilities-manual	
Industry Certifications	http://www.nccer.org Certificate in Core Curriculum	

Course Description
This instructional program prepares individuals to apply technical knowledge and skills to unite or separate metal parts by heating, using a variant of techniques and equipment. **Upon successful completion of this course students will be certified as NCCER core curriculum completers.**

Program Purpose/Structure
This course is based on selected modules from Core, Welding Level 1 and Welding level 2 NCCER curriculums.

Laboratory Activities
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Special Notes
Click here to enter text.

Career and Technical Student Organization (CTSO)
SkillsUSA

Arkansas Department of Career Education
Student Performance Standards

Course Title: **Welding Technology**
Course Number: **495570**
Course Credit: **1**

Welding Technology Indicators: At the completion of the course the student will be able to . . .

1.0 Identify and demonstrate proper welding safety
- 1.1 Follow safe work practices and procedures in accordance to OSHA standards.
  - 1.1.1 Explain the idea of a safety culture and its importance in the construction crafts and the role of OSHA in job-site safety,
  - 1.1.2 Determine violations to OSHA's General Duty Clause found in 1926 CFR Subpart C.
  - 1.1.3 Identify causes of accidents and the impact of accident costs.
  - 1.1.4 Recognize safety hazards and demonstrate risk assessment techniques.
  - 1.1.5 Explain fall protection as well as ladder, stair, and scaffold procedures and requirements.
  - 1.1.6 Demonstrate safe work procedures to use around electrical hazards.
  - 1.1.7 Demonstrate the use and care of appropriate personal protective equipment (PPE) and identify other construction hazards on the job site including hazardous material exposure, environmental elements, welding and cutting hazards, confined spaces, and fires.
  - 1.1.8 Explain the importance of hazard communication (HazCom) and Safety Data Sheets (SDSs).
- 1.2 Understand the hazards of welding and demonstrate the proper attitude toward safety.
  - 1.2.1 Identify some common hazards in welding and proper PPE used in welding.
  - 1.2.2 Demonstrate techniques for storing and handling compressed gas cylinders.
  - 1.2.3 Demonstrate how to avoid welding fumes.
  - 1.2.4 Explain some causes of accidents.
  - 1.2.5 Demonstrate the use of material safety data sheets.
  - 1.2.6 Demonstrate procedures to avoid electric shock when welding.
  - 1.2.7 Demonstrate proper material handling methods.
- 1.3 Recognize hazards and demonstrate proper safety procedures required for materials handling.
  - 1.3.1 Define a load, establish a pre-task plan prior to moving a load, and use proper material-handling techniques.

2.0 Apply mathematical procedures to welding tasks
- 2.1 Examine the theories behind some basic mathematical procedures and apply the procedures to related tasks.

2.1.1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2.1.2 Use a standard ruler, a metric ruler, and a measuring tape to measure.
2.1.3 Add, subtract, multiply, and divide fractions.
2.1.4 Add, subtract, multiple, and divide decimals, with and without a calculator.
2.1.5 Convert decimals to percentages and percentages to decimals.
2.1.6 Convert fractions to decimals and decimals to fractions.
2.1.7 Examine the metric system and its importance in the construction trade.
2.1.8 Recognize and use metric units of length, weight, volume, and temperature.
2.1.9 Recognize basic shapes used in the construction industry and apply basic geometry to measure them.

3.0 Handling and care of industry tools
3.1 Safely use and maintain common and/or specialized hand tools.
3.1.1 Recognize and identify basic hand tools and their proper uses in the construction trade.
3.1.2 Visually inspect hand tools to determine if they are safe to use.
3.2 Safely use and maintain common and/or specialized power tools.
3.2.1 Identify power tools commonly used in the construction trades.
3.2.2 Demonstrate safe use of power tools.
3.2.3 Explain and demonstrate how to maintain power tools properly.

4.0 Demonstrate appropriate employability skills
4.1 Discuss and apply the basic soft skills of the industry trade which include reading, writing, listening, and speaking.
4.1.1 Interpret information and instructions presented in both verbal and written form.
4.1.2 Communicate effectively in on-the-job situations using verbal and written skills.
4.1.3 Communicate effectively on the job using electronic communication devices.
4.2 Discuss and apply interpersonal skills that are needed to succeed in the welding industry.
4.2.1 Explain the role of an employee in the construction industry.
4.2.2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
4.2.3 Demonstrate knowledge of computer systems and explain commo9n uses for computers in the construction industry.
4.2.4 Demonstrate effective relationship skills.
4.2.5 Recognize and report on workplace issues such as sexual harassment, stress, and substance abuse.

5.0 Demonstrate proper welding techniques
5.1 Demonstrate processes of cutting, trimming, and shaping metals utilizing the oxyfuel process.
5.1.1 Identify and explain the use of oxyfuel cutting equipment.
5.1.2 Set up oxyfuel equipment.

5.1.3 Light and adjust an oxyfuel torch.
5.1.4 Shut down oxyfuel cutting equipment.
5.1.5 Disassemble oxyfuel equipment.
5.1.6 Change cylinders.
5.1.7 Perform various oxyfuel cutting techniques.
5.1.8 Operate a motorized, portable oxyfuel gas cutting machine.

5.2 Demonstrate the processes of piercing, cutting, and gouging metal utilizing the plasma arc cutting process.
5.2.1 Explain the plasma arc cutting processes.
5.2.2 Identify plasma arc cutting equipment.
5.2.3 Prepare and set up plasma arc cutting equipment.
5.2.4 Use plasma arc cutting equipment to make various types of cuts.
5.2.5 Properly store equipment and clean the work area after use.

5.3 Demonstrate the use of the Carbon Arc Cutting-Air (CAC-A) equipment, its operations, and its use for cutting and gouging metals.
5.3.1 Identify and demonstrate the air carbon arc cutting (CAC-A) process and equipment.
5.3.2 Select and install CAC-A electrodes.
5.3.3 Prepare the work are and CAC-A equipment for safe operation.
5.3.4 Use CAC-A equipment for washing and gouging activities.
5.3.5 Perform storage and housekeeping activities for CAC-A equipment.
5.3.6 Make minor repairs to CAC-A equipment.

5.4 Prepare various base metals to conform to the appropriate welding codes.
5.4.1 Clean base metal for welding or cutting.
5.4.2 Identify and explain joint designs and their uses.
5.4.3 Explain joint design considerations.
5.4.4 Mechanically bevel the edge of a mild steel plate.
5.4.5 Thermally bevel the end of a mild steel plate.
5.4.6 Select the proper joint design based on a welding procedure specification (WPS) or instructor direction.

6.0 Identify and interpret industry and welding symbols, drawings, and specifications

6.1 Interpret and draw welding symbols on specifications, drawings, and welding procedure specifications.
6.1.1 Interpret parts of a welding symbol.
6.1.2 Interpret groove weld symbols.
6.1.3 Read welding symbols on drawings, specifications, and welding procedure specifications.
6.1.4 Interpret welding symbols from a print.

6.2 Read and interpret assembly and detailed blueprints (prints).
- 6.2.1 Interpret a welding detail drawing.
- 6.2.2 Identify lines, material fills and sections.
- 6.2.3 Demonstrate object views.
- 6.2.4 Demonstrate dimensioning.
- 6.2.5 Identify and explain notes and bill of materials.
- 6.2.6 Interpret basic elements of a welding detail drawing.
- 6.2.7 Sketch or draw a basic welding drawing.

6.3 Interpret construction drawings, recognize classifications of drawings, and use drawing dimensions.
- 6.3.1 Recognize and identify basic construction drawing terms, components, and symbols.
- 6.3.2 Relate information on construction drawings to actual locations on the print.
- 6.3.3 Classify construction drawings.
- 6.3.4 Interpret and use drawing dimensions.

Standard 1.0 Identify and Demonstrate Proper Welding Safety			
Performance Indicator 1.1 Follow safe work practices and procedures in accordance to OSHA standards.	**Recommended Application/Activity Reference 00101-09**	**CCSS Standards**	**CCTC Standards**
1.1.1 Explain the idea of a safety culture and its importance in the construction crafts and the role of OSHA in job-site safety.	• Inspect PPE to determine if it is safe to use (PPE should include safety goggles, hard hat, gloves, safety harness, and safety shoes). • Perform a JHA (Job Hazard Analyses)	W11-12.3	MN3 CRP2
1.1.2 Determine violations to OSHA's General Duty Clause found in 1926 CFR Subpart C.	• Identify general duty clause violations.		
1.1.3 Identify causes of accidents and the impact of accident costs.	• Explain the effects of a work related accident to the worker and the company. • Demonstrate safe lifting procedures.	R11-12.3	MN3
1.1.4 Recognize safety hazards recognition and demonstrate risk assessment techniques.	• Set up an extension ladder properly • Demonstrate three-point contact on a ladder.	R11-12.1	MN3 CRP2
1.1.5 Explain fall protection as well as ladder, stair, and scaffold procedures and requirements.	• Explain Fall Protection for stairways & scaffolds.		
1.1.6 Demonstrate safe work procedures to use around electrical hazards.	• Demonstrate proper use of a grinder using an approved GFCI receptacle • Explain the Hazards of wet conditions while working with electricity.		MN5 MN3 CRP2
1.1.7 Demonstrate the use and care of appropriate personal protective equipment (PPE) and identify other construction hazards on your job site, including hazardous material exposures, environmental elements, welding and cutting hazards, confined spaces, and fires.	• Properly don and remove PPE (safety goggles, hard hat, and personal fall protection). • Demonstrate donning a safety harness and describe correct procedures for entering a confined space. • Explain long and short term effects of exposure to Hazards in their work area.		MN3 CRP2

1.1.6 Explain the importance of hazard communications (HazCom) and Safety Data Sheets (SDSs).	• Locate the SDS station and identify a certain product located in the lab area. • Explain the importance of labeling in the work environment.	R11.-12.1	MN5
Performance Indicator 1.2 Understand the hazards of welding and develop the proper attitude toward safety.	**Recommended Application/Activity Reference 00101-09**	**CCSS Standards**	**CCTC Standards**
1.2.1 Identify some common hazards in welding and proper PPE used in welding.	• Change empty cylinders. • Model PPE used in the welding lab.	SL11-12.1b	MN5 MN3 CRP2
1.2.2 Explain safety techniques for storing and handling compressed gas cylinders	• Demonstrate the safe handling of compressed gas cylinders in the lab area.		
1.2.3 Describe how to avoid welding fumes.	• Demonstrate how to keep their head out of the plume • Demonstrate working safely in the lab area. • Explain the effects of exposure to welding fumes to their body long and short term.	Click here to enter text.	MN5 MN3 CRP2
1.2.4 Explain some of the causes of accidents.	• Demonstrate working safely in the lab area. • Explain the difference between an accident and a near miss.	Click here to enter text.	MN5 MN3 CRP2
1.2.5 Identify and explain uses for material safety data sheets.	• Locate the SDS station and identify a certain product located in the lab area. • Using a SDS on a product used in the welding lab, demonstrate the hazards associated with the product, and the steps used to protect them from the hazards.	SL11-12.1b	MN5 MN3 CRP2
1.2.6 Explain how to avoid electric shock when welding.	• Identify the proper grounding and bonding of the equipment in the lab area. Measure the electrode lead and check for broken insulation.	Click here to enter text.	MN5 MN3 CRP2
1.2.7 Demonstrate proper material handling methods.	• Demonstrate safe lifting procedures		
Performance Indicator 1.3 Recognize hazards and follow safety procedures required for materials handling.	**Recommended Application/Activity Reference 00109-09 Introduction to Material Handling**	**CCSS Standards**	**CCTC Standards**
1.3.1 Define a load, establish a pre-task plan prior to moving a load, and	• Determine the weight value of a pallet of welding electrodes • Determine the size of the load and choose the suitable equipment	SL11-12.1b	MN5 MN3

use proper material-handling techniques.	to complete the task • Move the load		CRP2

Standard 2.0 Apply Mathematical Procedures to Welding Tasks			
Performance Indicator 2.1 Examine the theories behind some basic mathematical procedures and apply the procedures to related tasks.	**Recommended Application/Activity Reference 00102-09 Introduction to Construction Math**	**CCSS Standards**	**CCTC Standards**
2.1.1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.	• Determine the material needed from a job list using a calculator and without a calculator. • Read a material list.	R11-12.9	MN6
2.1.2 Use a standard ruler, a metric ruler, and a measuring tape to measure.	• Measure a pre-cut piece of welding stock material with each type ruler.	R11-12.9	MN6
2.1.3 Add, subtract, multiply, and divide fractions.	• Give students an assessment over the use of fractions	R11-12.9	MN6
2.1.4 Add, subtract, multiply, and divide decimals, with and without a calculator	• Give students an assessment over the use of fractions with a calculator and without one.	R11-12.9	MN6
2.1.5 Convert decimals to percentages and percentages to decimals.	• Give students an assessment over converting decimals and percentages.	R11-12.9	MN6
2.1.6 Convert fractions to decimals and decimals to fractions.	• Give students an assessment over converting fractions to decimals.	R11-12.9	MN6
2.1.7 Explain the metric system and its importance in the construction trade.	• Read a job sheet and determine which measurement is used and demonstrate attention to detail and how measurements are different.	R11-12.9	MN6
2.1.8 Recognize and use metric units of length, weight, volume, and temperature.	• Read a job sheet and determine which measurement is used and demonstrate attention to detail and how measurements are different.	R11-12.9	MN6
2.1.9 Recognize basic shapes used in the construction industry and apply basic geometry to measure them.	• Cut shapes from various thicknesses of steel, emphasizing: • Straight line • Square shape • Piercing • Bevel	R11-12.9	MN6

Standard 3.0 Handling and Care of Industry Tools			
Performance Indicator 3.1 **Safely use and maintain common and/or specialized hand tools.**	**Recommended Application/Activity** **Reference 00103-09 Introduction to Hand Tools**	**CCSS Standards**	**CCTC Standards**
3.1.1 Recognize and identify basic hand tools and their proper uses in the construction trade.	• Identify hand tools as used in the welding industry chipping hammer, ball peen hammer, sledge hammer, wire brush and a combination wrench	SL11-12.1b	MN3 CRP2
3.1.2 Visually inspect hand tools to determine if they are safe to use.	• Visually inspect the following tools to determine if they are safe to use: • Hammer • Screwdriver	SL11-12.1b	MN3 CRP2
Performance Indicator 3.2 **Safely use and maintain common and/or specialized power tools.**	**Recommended Application/Activity** **Reference 00104-09 Introduction to Power Tools**	**CCSS Standards**	**CCTC Standards**
3.2.1 Identify power tools commonly used in the construction trades.	• Inspect hand held grinder, porta-band saw, reciprocating saw, chop saw, band saw, drill press and drills.	SL11-12.1b	MN3 CRP2
3.2.2 Demonstrate safe use of power tools.	• Demonstrate the proper use of a hand held grinder.		MN3 CRP2
3.2.3 Explain and demonstrate how to maintain power tools properly	• Inspect the power tools cords for damage. • Ensure all ground lugs are in the proper place on all extension cords and in working equipment. • Explain the difference between double insulated power tools and extension cords in relation to ground plug lugs on cords.	SL11-12.3	MN3 CRP2

Standard 4.0 Demonstrate Appropriate Employability Skills			
Performance Indicator 4.1 Discuss and apply the basic soft skills of the industry trade which include reading, writing, listening, and speaking.	**Recommended Application/Activity Reference 00107-09 Basic Communication Skills**	**CCSS Standards**	**CCTC Standards**
4.1.1 Interpret information and instructions presented in both verbal and written form.	• Fold a paper airplane by following verbal instructions and one with a written instructions.	SL11-12.1	MN3 CRP2
4.1.2 Communicate effectively in on-the-job situations using verbal and written skills.	• Fill out a job application, and a resume. • Hold a mock job interview.	W11-12.5 W11-12.6	MN3 CRP2
4.1.3 Communicate effectively on the job using electronic communication devices.	• Send an e-mail to their instructor.	SL11-12.1	MN3 CRP2
Performance Indicator 4.2 Discuss and apply interpersonal skills that are needed to succeed in the welding industry.	**Recommended Application/Activity Reference 00108-09 Basic Employability Skills**	**CCSS Standards**	**CCTC Standards**
4.2.1 Explain the role of an employee in the construction industry.	• Perform a given task after listening to oral instructions, without mistakes, in a timely manner. • Take notes on specific details.	SL11-12.1	MN3 CRP2
4.2.2 Demonstrate critical thinking skills and the ability to solve problems using those skills.	• Demonstrate the ability to access, retrieve, and print from the following basic software programs:•Email•Databases•Internet	SL11-12.1b	MN3
4.2.3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.	• Go online and navigate to www.osha.gov.		MN3 CRP2
4.2.4 Define effective relationship skills.	• Demonstrate appropriate professional conduct in the work place.	SL11-12.3	MN5 CRP2

4.2.5 Recognize and report on workplace issues such as sexual harassment, stress, and substance abuse.	• • Define the type of discriminations found in the work place and describe the effects of stress and substance abuse in the work place. • Report any unfair treatment in the workplace.	SL11-12.3	MN3 CRP2

Standard 5.0 Demonstrate Proper Welding Techniques			
Performance Indicator 5.1 Demonstrate the processes of cutting, trimming, and shaping metals utilizing the oxyfuel process.	**Recommended Application/Activity Reference 29102-09 Oxyfuel Cutting**	**CCSS Standards**	**CCTC Standards**
5.1.1 Identify and explain the use of oxyfuel cutting equipment.	• Demonstrate a knowledge of and set up the oxyfuel cutting equipment.	R11-12.9	MN3 CRP2
5.1.2 Set up oxyfuel equipment.	• Light and adjust an oxyfuel torch. Properly set up oxyfuel equipment ready for use. Set the torch to a neutral flame, carburizing flame and an oxidizing flame.	SL11-12.4	MN3
5.1.3 Light and adjust an oxyfuel torch.	• Light and adjust an oxyfuel torch.	L11-12.6	MN3 CRP2
5.1.4 Shut down oxyfuel cutting equipment.	• Shut down oxyfuel cutting equipment.	R11-12.2	MN5 MN3 CRP2
5.1.5 Disassemble oxyfuel equipment.	• Disassemble oxyfuel equipment.	R11-12.9	MN3 CRP2
5.1.6 Change cylinders.	• Change empty cylinders. (Students cannot roll a compressed gas cylinder more than 10 feet according to OSHA standards.)	SL11-12.4	MN3
5.1.7 Perform oxyfuel cutting: • Straight line and square shapes • Piercing and slot cutting • Bevels • Washing • Gouging	• Cut shapes from various thicknesses of steel, emphasizing:• Straight line• Square shape• Piercing• Bevel• Slot. (The students will have all proper PPE donned. Prior to preforming their cutting task.)	L11-12.6	MN3 CRP2
5.1.8 Operate a motorized, portable oxyfuel gas cutting machine.	• Demonstrate the correct use and operation of a track torch, with the appropriate setting of fuel gas and oxygen. (The students will	R11-12.2	MN3 CRP2

	have all proper PPE donned. Prior to preforming their cutting task.)		
Performance Indicator 5.2 Demonstrate the processes of piercing, cutting, and gouging metal utilizing the plasma arc cutting process.	**Recommended Application/Activity Reference 29103-09 Plasma Arc Cutting**	**CCSS Standards**	**CCTC Standards**
5.2.1 Explain the plasma arc cutting processes.	• Describe and explain how the process of plasma arc cutting works.	R11-12.9	CRP2
5.2.2 Identify plasma arc cutting equipment.	• Describe the difference between transfer and non-transfer plasma arc cutting	SL11-12.4	MN3 CRP2
5.2.3 Prepare and set up plasma arc cutting equipment.	• Set the amperage and gas pressures or flow rates for the type and thickness of metal to be cut	L11-12.6	MN3 CRP6
5.2.4 Use plasma arc cutting equipment to make various types of cuts.	• Square-cut metal using plasma arc cutting equipment. Bevel-cut metal using plasma arc equipment. Pierce and cut slots in metal using plasma arc cutting equipment.	R11-12.2	CRP2
5.2.5 Properly store equipment and clean the work area after use.	• Dismantle and store the equipment	R11-12.9	CRP2
Performance Indicator 5.3 Demonstrate the use of Carbon Arc Cutting-Air (CAC-A) equipment, its operations, and its use for cutting and gouging metals	**Recommended Application/Activity Reference 29104-09 Air Carbon Arc Cutting and Gouging**	**CCSS Standards**	**CCTC Standards**
5.3.1 Identify and demonstrate the air carbon arc cutting (CAC-A) process and equipment.	• Demonstrate a working knowledge of CAC-A	W11-12.3	MN3 CRP2
5.3.2 Select and install CAC-A electrodes.	• Select and install CAC-A electrodes.	R11-12.3	MN3
5.3.3 Prepare the work area and CAC-A equipment for safe operation.	• Prepare the work area and CAC-A equipment for safe operation. • Student must perform a Job Hazard Analysis prior to using the CAC.	R11-12.1	MN3 CRP2
5.3.4 Use CAC-A equipment for washing and gouging activities.	• Use CAC-A equipment for washing. Use CAC-A equipment for gouging		MN5 MN3

			CRP2
5.3.5 Perform storage and housekeeping activities for CAC-A equipment.	• Perform storage and housekeeping activities for CAC-A equipment.	R11-12.1	MN3 CRP2
5.3.6 Make minor repairs to CAC-A equipment.	• Repair an air hose extinguish a class “A” fire.	R11-12.1	MN3 CRP2
Performance Indicator 5.4 Prepare various base metals to conform to the appropriate welding codes.	**Recommended Application/Activity Reference 29105-09 Base Metal Preparation**	**CCSS Standards**	**CCTC Standards**
5.4.1 Clean base metal for welding or cutting.	• Remove mill scale, solvents, degreasers, paint, rust and other outside contaminants from the base metal using a mechanical or chemical process while wearing the proper PPE.	R11-12.1	MN3 CRP2
5.4.2 Identify and explain joint designs and their uses.	• Explain the five basic joints and their variations of use.	R11-12.3	MN3
5.4.3 Explain joint design considerations.	• Explain the load that will be applied to the structure.	R11-12.1	MN3 CRP2
5.4.4 Mechanically bevel the edge of a mild steel plate.	• Prepare a bevel on a plate with a grinder if a nibbler is unavailable while wearing the proper PPE.	R11-12.1	MN5 MN3 CRP2
5.4.5 Thermally bevel the end of a mild steel plate.	• Prepare a bevel on a plate with a track torch and a combination torch and a mechanical guide while wearing the proper PPE.	R11-12.1	MN3 CRP2
5.4.6 Select the proper joint design based on a welding procedure specification (WPS) or instructor direction.	• Interpret a WPS correctly selecting the joint specified in the WPS	R11-12.1	MN3 CRP2

Standard 6.0 Identify and Interpret Industry and Welding Symbols, Drawings, and Specifications			
Performance Indicator 6.1 Interpret and draw welding symbols on specifications, drawings, and welding procedure specifications.	**Recommended Application/Activity Reference 29201-09 Welding Symbols**	**CCSS Standards**	**CCTC Standards**
6.1.1 Interpret parts of a welding symbol.	• Identify and interpret welding symbols on a provided drawing.	R11-12.1	MN3 CRP2
6.1.2 Interpret fillet and groove weld symbols.	• Identify and interpret welding symbols on a provided drawing.	R11-12.1	MN3 CRP2
6.1.3 Read welding symbols on drawings, specifications, and welding procedure specifications.	• Identify and interpret welding symbols on a provided drawing.	R11-12.1	MN3 CRP2
6.1.3 Interpret welding symbols from a print.	• Identify and interpret welding symbols on a provided drawing.	R11-12.1	MN3 CRP2
Performance Indicator 6.2 Read and interpret assembly and detailed blueprints (prints).	**Recommended Application/Activity Reference 29202-09 Reading Welding Detail Drawings**	**CCSS Standards**	**CCTC Standards**
6.2.1 Interpret a welding detail drawing.	• Use a welding detail drawing to successfully complete a project.	R11-12.1	MN3 CRP2
6.2.2 Identify lines, material fills, and sections.	• Complete assessment by identifying these items on a detail drawing.	R11-12.1	MN6
6.2.3 Demonstrate object views.	• Show examples of isometric view, multi-view and section view.	R11-12.1	MN6 CRP2
6.2.4 Interpret and use dimensioning.	• Show and understand the two basic methods of conventional dimensioning and base line dimensioning.	R11-12.1	MN5 MN3 CRP2
6.2.5 Identify and explain notes and bill of materials.	• Locate notes and bill of materials on the drawing.	R11-12.1	MN3
6.2.6 Interpret basic elements of a welding detail drawing.	• Interpret the basic elements of a detailed drawing.	R11-12.1	MN3

6.2.7 Sketch or draw a basic welding drawing.	• Sketch a basic welding drawing with dimensions and welding symbols.	R11-12.1	MN3
Performance Indicator 6.3 Interpret construction drawings, recognize classifications of drawings, and use drawing dimensions.	**Recommended Application/Activity Reference 00105-09 Introduction to Construction Drawings**	**CCSS Standards**	**CCTC Standards**
6.3.1 Recognize and identify basic construction drawing terms, components, and symbols	• Interpret symbols pertaining to basic construction drawings. • Interpret components pertaining to basic construction drawings. • Demonstrate knowledge of drawing terms.	R11-12.1	MN3 CRP2
6.3.2 Relate information on construction drawings to actual locations on the print	• Use a construction drawing to identify actual locations on the print under supervision of the Instructor.	R11-12.1	MN3
6.3.3 Classify construction drawings.	• Given a group of drawings, group them into their proper classification.	R11-12.1	MN3 CRP2
6.3.4 Interpret and use drawing dimensions.	• Show and understand the two basic methods of conventional dimensioning and base line dimensioning. • Take a dimension of an object from the drawing and cut the actual part to the correct dimension while wearing the correct PPE	R11-12.1	MN5 CRP2

Common Core State Standards Grades 9-12

ELA Speaking and Listening Standards Grades 11-12

1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL11-12.1**
    a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. **SL11-12.1a**
    b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. **SL11-12.1b**
    c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. **SL11-12.1c**
    d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. **SL11-12.1d**
2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. **SL11-12.2**
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. **SL11-12.3**
4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. **SL11-12.4**
5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **SL11-12.5**

ELA Language Grades 11-12

4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies. **L11-12.4**
    a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase. **L11-12.4a**

b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable). **L11-12.4b**
c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage. **L11-12.4c**
d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary **L11-12.4d**

6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. **L11-12.6**

Reading Standards for Literacy in Science and Technical Subjects Grades 11-12

1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **R11-12.1**
2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. **R11-12.2**
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. **R11-12.3**
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. **R11-12.4**
5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. **R11-12.5**
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. **R11-12.6**
7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **R11-12.7**
8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **R11-12.8**
9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **R11-12.9**
10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently. **R11-12.10**

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects Grades 11-12

1. Write arguments focused on discipline-specific content. **W11-12.1**
   a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. **W11-12.1a**
   b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. **W11-12.1b**
   c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. **W11-12.1c**
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. **W11-12.1d**
   e. Provide a concluding statement or section that follows from or supports the argument presented. **W11-12.1e**
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **W11-12.2**
   a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. **W11-12.2a**
   b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. **W11-12.2b**
   c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. **W11-12.2c**
   d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. **W11-12.2d**
   e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). **W11-12.2e**
3. Write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results. **W11-12.3**
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
   W11-12.4
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **W11-12.5**

6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. **W11-12.6**
7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **W11-12.7**
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. **W11-12.8**
9. Draw evidence from informational texts to support analysis, reflection, and research. **W11-12.9**
10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. **W11-12.10**

Common Career and Technical Core Standards

Manufacturing Career Cluster

Manufacturing Career Cluster Standards (MN)

1. Evaluate the nature and scope of the Manufacturing Career Cluster and the role of manufacturing in society and in the economy. **MN1**
2. Analyze and summarize how manufacturing businesses improve performance. **MN2**
3. Comply with federal, state, and local regulations to ensure worker safety and health and environmental work practices. **MN3**
4. Describe career opportunities and the means to achieve those opportunities in each Manufacturing Career Pathways. **MN4**
5. Describe government policies and industry standards that apply to manufacturing. **MN5**
6. Demonstrate workplace knowledge and skills common to manufacturing. **MN6**

Maintenance, Installation and Repair Career Pathway (MN-MIR)

1. Demonstrate maintenance skills and proficient operation of equipment to maximize manufacturing performance. **MN-MIR1**
2. Demonstrate the safe use of manufacturing equipment to ensure a safe and healthy environment. **MN-MIR2**
3. Diagnose equipment problems and effectively repair manufacturing equipment. **MN-MIR3**
4. Investigate and employ techniques to maximize equipment performance. **MN-MIR4**
5. Implement a preventative maintenance schedule to maintain manufacturing equipment, tools, and workstations. **MN-MIR5**
6. Implement an effective, predictive, and preventive manufacturing equipment maintenance program. **MN-MIR6**

Production Career Pathway (MN-PRO)

1. Diagnose production process problems and take corrective action to meet production quality standards. **MN-PRO1**
2. Manage safe and healthy production working conditions and environmental risks. **MN-PRO2**
3. Make continuous improvement recommendations based on results of production process audits and inspections. **MN-PRO3**
4. Coordinate work teams when producing products to enhance production process and performance. **MN-PRO4**
5. Demonstrate the safe use of manufacturing equipment. **MN-PRO5**

Common Career and Technical Core Career Ready Practices (CCTC CRP)

1. Act as a responsible and contributing citizen and employee. **CRP1**
2. Apply appropriate academic and technical skills. **CRP2**
3. Attend to personal health and financial well-being. **CRP3**
4. Communicate clearly, effectively, and with reason. **CRP4**
5. Consider the environmental, social and economic impacts of decisions. **CRP5**
6. Demonstrate creativity and innovation. **CRP6**
7. Employ valid and reliable research strategies. **CRP7**
8. Utilize critical thinking to make sense of problems and persevere in solving them. **CRP8**
9. Model integrity, ethical leadership, and effective management. **CRP9**
10. Plan education and career path aligned to personal goals.**CRP10**
11. Use technology to enhance productivity. **CRP11**
12. Work productively in teams while using cultural/global competence. **CRP12**